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Cut-down, Annoyed, Guilt, Eye-opener (CAGE)  
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**Paradoxical increase of positive answers to the CAGE questionnaire during  
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Short Title: Paradoxical increase of positive answers to CAGE

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**Paradoxical increase of positive answers to the CAGE questionnaire during a period of decreasing alcohol consumption: results from two population-based surveys in Île-de-France, 1991 and 2005.**

Antoine Messiah, Gaëlle Encrenaz, David Sapinho, Fabien Gilbert, Elodie Carmona, Viviane Kovess-Masféty.

***Abstract***

Aims: To describe trends of responses to the CAGE questionnaire during a period of declining alcohol consumption, in a country with no temperance history.

Design: Two random-sample surveys, conducted in 1991 and 2005 respectively.

Setting: The adult population of Ile-de-France.

Participants: 1183 subjects in 1991, 5382 subjects in 2005.

Measurements: Responses to CAGE questions, obtained by face-to-face interviews in 1991 and by telephone in 2005. Results were standardized on the 2005 population structure.

Findings: The proportion of subjects giving at least two positive answers has increased by 4.2 times; the biggest increase was observed for the *Guilt* question (4.8 times), and the smallest, for the *Eye-opener* question (2.6 times). Several increases were higher for women than for men: 12.9 times vs. 3.3 times for two or more positive answers, 9.8 times vs. 3.8 times for the *Guilt* question. Increases did not vary consistently by age.

Conclusion: These paradoxical trends do not support the use of CAGE in general population surveys. They confirm previous reports suggesting that CAGE was sensitive to community temperance level. They might reflect the emergence of a temperance movement in France, with stronger impact among women. This movement might be responsible for the fall in alcohol consumption.

***Key words (MeSH) :***

Questionnaires/standards, Alcoholism/diagnosis, Alcohol Drinking, Temperance, Health Surveys.

## Introduction

Since its inception in 1974 [1, 2], the CAGE questionnaire has been considered as a useful tool for screening alcohol use disorders in clinical populations of western countries [3-19]. It has also been evaluated and used in epidemiological surveys that attempted to estimate levels of alcohol-related disorder in various populations [4, 20-34]. However, some studies found that, when used as an epidemiological tool in general populations, the CAGE had a questionable validity [22, 24, 25, 31, 34]. While CAGE trends, with paradoxical results, were reported in North America [24, 35, 36], there is no such report in countries without temperance history. France is such a country, with a long standing history of alcohol consumption: it ranked first worldwide until 1983, in per capita yearly alcohol intake, and stayed in the top 6 countries since then [37]. This intake, however, has been declining over the past 45 years, from 26.0 litres of ethanol per capita in 1961 to 15.4 litres in 1990 and to 12.7 litres in 2005 [38, 39]. We report here results of CAGE scores obtained by two surveys conducted 15 years apart in the same geographic area during this decline.

## Subjects and methods

The two surveys were cross-sectional, and used a sampling frame of the population covering the city of Paris and its region (“Île-de-France”, 11 million people in 2000 [40]). They were conducted in 1991 and 2005, respectively. Both surveys were approved by the French regulation authority for questionnaire-based non-invasive medical research. They aimed at assessing mental and physical health, handicaps and patterns of medical consultation among adults of all ages ( $\geq 18$ ).

### Sample

The 1991 survey was conducted jointly by the Public Health Department of a French mutual health-insurance company, the MGEN (Mutuelle Générale de l'Éducation Nationale) and the French National Institute for Statistics and Economic Studies (INSEE) which is in charge of conducting census. The sampling method followed a multistage, stratified random procedure, similar to the procedure used for the census. It selected 1716 households, of which 1349 (78.6%) gave the necessary information to proceed to the random selection of one potential participant, who underwent a face-to-face interview. The final sample consisted of 1183 subjects (participant response rate 87.6%).

The 2005 survey was conducted by a large private poll company (Ipsos) under the supervision of the MGEN Public Health. Listed and unlisted phone numbers were covered by a list-assisted sampling method: the last digit of listed numbers was replaced by a randomly chosen digit. This procedure selected 8544 households, of which 7408 (86.7%) gave the necessary information to proceed to the random selection of one potential participant. Contact could not be established for 1584 of them (not reached after 15 attempts, not French-speaking, physically or mentally disabled). Among the 5641 contacted, 5011 gave complete interview

(participant response rate 88.8%). Since in France the directory comprises only cabled-phone numbers, random digit dialing was used to extend the coverage to households equipped with mobile phones only. Four-digit prefixes allocated to mobile phone (all under the form 06dd regardless of geographical area), obtained from the telephone regulation authority, were complemented by six digits generated at random. Subjects were selected if their number corresponded to a non-business mobile phone and if their household was unequipped with a cabled phone. Among the 3698 subjects thus contacted, 2061 gave complete interview (participant response rate 55.7%). Among them, only those living in Île-de-France were selected for the current study ( $n = 370$ ) and combined with the cabled-phone sample (final  $N=5082$ ).

### ***Data collection***

For both surveys, an informed consent was required. Then, socio-demographic data, health status, use of care, and mental health information were collected by professional poll interviewers. Interviewers were provided with two days of specific training by the research team. In both surveys, CAGE was submitted after questions regarding socio-demographic information and non substance-related health issues, and before the questions addressing alcohol, tobacco, and substance-related disorders. Questions regarding alcohol abuse or dependence were asked only to subjects with  $CAGE \geq 2$ .

### ***Sample weights and data analysis***

In order to adjust for differential representation, the observations were weighted by the reciprocal of the selection probability [41, 42]. Individuals of the mobile-phone survey extension were given a weight of 1.5, so that their proportion in the sample would be 10% as in the population of Ile-de-France [43]. Weights were further modified to achieve non-



response and post-stratification adjustments with regard to age, gender and socio-economic status [41, 42, 44, 45]. In order to get results for the 1991 survey standardized on the 2005 population structure, distribution of these variables was taken from the 2005 population data for both surveys [40]. Analysis was conducted with the Stata statistical software, which is suited to analyze weighted data [46].

## Results

In the overall sample, the 1991 proportion of positive answers to each CAGE questions ranged from 4.3 down to 0.5. The biggest increase was observed for the *Guilt* question, and the smallest, for the *Eye-opener* question. While percents of positive answers were higher among men than among women, the 1991-to-2005 increases were higher for women than for men. The biggest increase was observed for the *Guilt* question among women (9.8), and the smallest, for the *Eye-opener* question among men (2.4). The proportion of subjects giving at least two positive answers had increased 3.3 times among men and 12.9 times among women.

*Insert Table 1 here*

Percents of positive answers to each CAGE questions were lower among subjects aged 50 or more. Discrepancies between the two other age groups (18-34 and 35-49 years old) were not consistent from one question to the next. Analysis by age of the 1991-to-2005 trends did not show figures that would be systematic across all CAGE questions, unlike the analysis by gender.

*Insert Table 2 here*

## Discussion

This paper reports paradoxical increases of positive answers to CAGE in a period of decreasing alcohol consumption. Increases could be due to survey methodological differences. Face-to-face interviews produce higher response rates but elicit more socially desirable answers than telephone interviews [47, 48]. By contrast, since unemployed people are more difficult to reach by telephone and are more likely to have alcohol-related problems [47-52], the 2005 survey might have under-covered people with positive CAGE answers. In addition, because telephone cannot provide the interviewer with non-verbal cues, the interviewee might feel freer to covert alcohol-related problems. Thus, how much of bias can account for the 1991-2005 differences is impossible to evaluate, and these differences might also be underestimated. It is unlikely, however, that such differences are pure artifacts: the bias would have to be of unprecedented magnitude, quite inconsistent within the same theme, and consistently gender-sensitive.

Trends could be due to an increase of alcohol consumption in Île-de-France meanwhile the rest of the country would experience the contrary. But mortality due to liver cirrhosis has declined in France and in Île-de-France in parallel ways during the 1981-1999 period, among both genders, which indicates that people are not less sober in Île-de-France.

Our data did not allow a straightforward assessment of consumption decrease, because of discrepancies between questionnaires. The past week number of drink was available in 1991, and showed that 8.0% of subjects had drunk at least 4 glasses per day. Equivalent data was not directly available in 2005, since only subjects with CAGE $\geq$ 2 were interviewed about their consumption, and were asked to report their number of drinks on past-year's peak day. However, imputations based on this report and from consumption data of another large survey conducted in 2005 with the same methodology [53] allowed us to infer that, in our

2005 survey, the percent of subjects drinking at least 4 glasses per day the week prior to interview would be less or equal to 6.3%, that is less than in 1991 (detailed imputation method can be obtained from first author upon request). This decrease is in line with results from Health Barometers investigating alcohol consumption in detail and conducted over the period 1995-2005 [53, 54]. It is also in line with several other consumption indices [55].

Paradoxical trends like ours have been described in North-America [24, 35, 36]. In Quebec, an increase of positive CAGE score occurred in the face of a decrease in alcohol consumption between 1987 and 1992. In USA, one study showed no change in either alcohol-dependence symptoms or social consequences of heavy drinking between 1984 and 1990, although heavy drinking had declined during that period; another study showed an increase of 12-month alcohol abuse (but a decrease of alcohol dependence) between 1991-1992 and 2001-2002, in the face of slightly declining rates of several heavy-drinking indicators. All these paradoxical trends were seen as signs of new temperance movements. However, unlike Canada and USA, France has no temperance history [56]. Thus, it is the first time that such paradoxical trends are reported within a wet country.

National surveys of Germany and USA conducted in 1995 allowed to perform cross-cultural comparisons [57]. Higher percents of current drinkers, higher values of various drinking indices, and lower underreporting of drinking were found in Germany. Answers to the CAGE suggested the opposite, with C and G questions acknowledged more often by Americans. Given the long-lasting history of temperance and the culture of "*dryness*" in USA, versus the contrary in Germany [56-58], answers to CAGE could be viewed as indicators of the drinking norms: it reveals what is considered as unacceptable, and presume awareness and willingness to admit to a drinking problem.

Thus, our results might reflect the emergence of a temperance movement in France, with a stronger impact on women. With the promulgation of the "loi Evin" (Evin law), 1991 was a pivotal year in France's anti-alcohol campaigns [59, 60]. This law restricted the advertisement and sponsoring of alcoholic beverage, strengthened driving safety regulations, and was accompanied by campaigns promoting non-alcoholic beverages. It prohibited distribution and consumption of alcohol in sport facilities, except special events upon request. Alcohol advertisements were forbidden on screen, and posters were constrained to deliver messages against alcohol abuse. Driving regulations included the possibilities of alcohol controls in the absence of accident or offence, the prohibition of alcohol sale in gas stations at evening and night times, and the lowering of maximum alcohol concentration in blood; this concentration, combined with responsibility into accident and accident toll, became the basis for punishment severity. Anti-alcohol campaigns promoted abstinence for pregnant women and for drivers, and moderation for other adults, with a maximum of two and three drinks per day for women and men, respectively. These campaigns may have changed the feelings toward drinking dramatically, with a shift from pride to shame, especially among women since they would out pass good practices at lower levels.

However, since the E question addresses alcohol dependence symptoms, it might have captured an actual increase of dependent drinkers and/or an increase of binge drinking and subsequent hangovers. Part of the increase in CAG questions might also have captured such changes, as far as acceptance of binge/massive drinking is low in "wet" cultures [58]. We could not document pattern changes because of the discrepancies between questionnaires mentioned earlier. A drinking pattern switch from regular and socialized towards occasional and "time out" would further establish an ongoing cultural change from "wet" to "dry" [58].

This study reinforces criticism that have been made regarding the true diagnostic or screening value of the CAGE questionnaire and further suggests that it reveals social

intolerance to heavy drinking [24, 57]. It should be used with caution when dealing with time trends.

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Conflicts of interest: none.

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## Tables

### Table 1

Distribution of responses to the CAGE items in the Ile-de-France population in 1991 and 2005, overall and by gender, and ratio of the 2005 percent over the 1991 percent and its 95% confidence interval. Percents are weighted; weights were computed according to the 2005 population structure for both surveys.

<i>Item</i>	<i>Sample</i>	1991 % (1)	2005 % (2)	Ratio (2)/(1)	95% CI of ratio (2)/(1)
<b>Sample size</b>	<i>Overall</i>	N=1183	N=5382		
	<i>Men</i>	N=546	N=2554		
	<i>Women</i>	N=637	N=3128		
<b>C (cut down)</b>	<i>Overall</i>	4.3	16.6	3.9	2.9 – 5.1
	<i>Men</i>	6.7	24.1	3.6	2.6 – 4.9
	<i>Women</i>	2.1	9.8	4.8	2.7 – 8.5
<b>A (annoyed)</b>	<i>Overall</i>	2.7	9.1	3.4	2.4 – 4.9
	<i>Men</i>	4.4	14.0	3.1	2.1 – 4.8
	<i>Women</i>	1.1	4.8	4.4	2.1 – 9.1
<b>G (guilt)</b>	<i>Overall</i>	1.7	8.2	4.8	3.1 – 7.3
	<i>Men</i>	3.0	11.3	3.8	2.4 – 5.9
	<i>Women</i>	0.6	5.5	9.8	3.0 – 30.8
<b>E (eye opener) Men</b>	<i>Overall</i>	0.5	1.3	2.6	1.1 – 5.8
	<i>Men</i>	0.9	2.2	2.4	1.0 – 5.7
	<i>Women</i>	0.1	0.5	4.3	0.6 – 32.5
<b>At least one positive answer (score &gt;= 1)</b>	<i>Overall</i>	5.8	22.5	3.9	3.1 – 4.9
	<i>Men</i>	8.8	32.7	3.7	2.8 – 4.9
	<i>Women</i>	3.0	13.4	4.4	2.8 – 6.9
<b>At least two positive answers (score &gt;= 2)</b>	<i>Overall</i>	2.1	9.0	4.2	2.8 – 6.4
	<i>Men</i>	4.0	13.2	3.3	2.1 – 5.0
	<i>Women</i>	0.4	5.2	12.9	3.1 – 53.1

**Table 2**

Distribution of responses to the CAGE items by age in the Ile-de-France population in 1991 and 2005, and ratio of the 2005 percent over the 1991 percent and its 95% confidence interval. Percents are weighted; weights were computed according to the 2005 population structure for both surveys.

<i>Item</i>	<i>Age</i>	1991 % (1)	2005 % (2)	Ratio (2)/(1)	95% CI of ratio (2)/(1)
<b>Sample size</b>	<b>18-34</b>	N = 377	N = 1751		
	<b>35-49</b>	N = 365	N = 1542		
	<b>50+</b>	N = 441	N = 2089		
<b>C</b>	<b>18-34</b>	2.9	14.8	5.1	2.8 – 9.4
	<b>35-49</b>	6.3	17.0	2.7	1.8 – 4.0
	<b>50+</b>	3.7	17.8	4.9	2.9 – 8.0
<b>A</b>	<b>18-34</b>	3.1	10.6	3.4	1.9 – 6.2
	<b>35-49</b>	3.0	9.8	3.3	1.8 – 6.0
	<b>50+</b>	2.1	7.5	3.6	1.7 – 7.5
<b>G</b>	<b>18-34</b>	2.2	10.4	4.7	2.4 – 9.1
	<b>35-49</b>	2.3	8.9	3.8	1.9 – 7.4
	<b>50+</b>	0.8	6.0	7.6	2.9 – 19.7
<b>E</b>	<b>18-34</b>	0.5	1.8	3.6	0.9 – 15.5
	<b>35-49</b>	0.8	1.4	1.7	0.5 – 5.9
	<b>50+</b>	0.2	0.8	3.3	0.7 – 15.3
<b>Score &gt;= 1</b>	<b>18-34</b>	5.6	24.4	4.4	2.9 – 6.7
	<b>35-49</b>	6.9	22.4	3.3	2.2 – 4.8
	<b>50+</b>	5.0	21.1	4.2	2.7 – 6.5
<b>Score &gt;= 2</b>	<b>18-34</b>	2.4	9.8	4.0	2.0 – 8.2
	<b>35-49</b>	2.7	9.7	3.5	1.9 – 6.5
	<b>50+</b>	1.3	7.8	5.8	2.5 – 13.6